

REMARKS/ARGUMENTS

Favorable reconsideration of this application, in view of the present amendment and in light of the following discussion, is respectfully requested.

Claims 1-13 are pending. In the present amendment, Claims 1-10 are currently amended and new Claims 11-13 are added. Support for the present amendment can be found in the original specification, for example, at page 7, lines 17-19, at page 8, lines 11-21, in Figure 4, and in original Claims 1, 6, and 10. Thus, it is respectfully submitted that no new matter is added.

In the outstanding Office Action, the specification was objected to; Claim 1 was rejected under 35 U.S.C. § 112, Second Paragraph; Claims 4-5 were objected to; Claims 1-3, 6, 7, and 10 were rejected under 35 U.S.C. § 102(b) as anticipated by Siska et al. (U.S. Patent No. 6,466,681, hereinafter "Siska"); and Claims 4, 5, 8, and 9 were rejected under 35 U.S.C. § 103(a) as unpatentable over Siska.

With respect to the objection to the specification, a substitute specification is filed herewith that clarifies the Examiner's objection to use of the term "dark noise." The term "dark noise" has been amended to refer to noise trapped inside the housing. It is respectfully submitted that no new matter is added. Thus, it is respectfully requested that the objection to the specification be withdrawn.

In response to the objections to Claims 4-5, Claims 4-5 are presently amended to remove the term "is used as," as suggested by the Examiner. Accordingly, it is respectfully requested that the objections to Claims 4-5 be withdrawn.

Turning now to the rejections under 35 U.S.C. § 112, Second Paragraph, 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a), Applicant respectfully requests reconsideration of these rejections and traverse these rejections, as discussed below.

Amended Claim 1 recites:

A headphone apparatus, comprising:

a baffle portion formed to surround a space except a front opening portion of a driver unit.

Amended Claim 1 cures the informalities cited by the Examiner in the 35 U.S.C.

§ 112, Second Paragraph rejection. In view of amended Claim 1, it is believed that all pending claims are definite and no further rejection on that basis is anticipated. However, if the Examiner disagrees, the Examiner is invited to telephone the undersigned who will be happy to work with the Examiner in a joint effort to derive mutually acceptable language.

Turning now to the rejection of Claim 1 under 35 U.S.C. § 103(a), the baffle portion of the headphone apparatus in amended Claim 1 is located in a space within the headphone apparatus, except in a front opening portion of a driver unit. It is respectfully submitted that the cited reference does not disclose or suggest every feature recited in amended Claim 1.

In Siska, a sound attenuating ear cup foam barrier 15 (cited in the Office Action as corresponding to the claimed baffle portion) ***directly and completely surrounds*** a front opening portion of a speaker 16, as seen in Figure 4A of Siska. Further, Siska states that “in Fig. 4B, the ear cup plate, membrane, and ***foam barrier have been omitted***.”¹

However, it is respectfully submitted that Siska does not disclose or suggest “a baffle portion formed to surround a space except a front opening portion of a driver unit,” as recited in amended Claim 1.

Instead, there is a difference in arrangement of the baffle portion recited in Claim 1 and the foam barrier 15 recited in Siska. The foam barrier 15 in Siska surrounds the speaker 16, as seen in Figure 4A, including the space in front of the speaker 16. Thus, it is respectfully submitted that the cited reference does not disclose or suggest every feature recited in amended Claim 1. Accordingly, it is respectfully requested that the rejections of

¹ See Siska, at col. 7, lines 12-14.

Claim 1, and all claims dependent thereon, as anticipated by or unpatentable over Siska be withdrawn.

Regarding the rejections of Claims 3, 4, 5, 8, and 9 as unpatentable over Siska, it is noted that Claims 3, 4, 5, 8, and 9 are amended to depend on Claim 11. Accordingly, the rejections of Claims 3, 4, 5, 8, and 9 will be discussed below.

New Claims 11-13 are added by the present amendment. Support for new Claims 11-13 can be found in the original specification, for example, at page 7, lines 17-19, at page 8, lines 11-21, and in original Claims 1, 6, and 10. Thus, it is respectfully submitted that no new matter is added.

Claim 11 recites that “the back housing portion is formed of an air-permeable porous material.” The back housing in Siska consists of a shell 18. Siska does not disclose or suggest that the shell 18 is made of an air-permeable porous material. Thus, it is respectfully submitted that Claim 11 patentably defines over the cited reference.

Regarding the rejection of Claim 3 as anticipated by Siska, it is noted that Claim 3 is dependent on Claim 11, and thus is believed to be patentable for at least the reasons discussed above with respect to Claim 11. Accordingly, it is respectfully requested that the rejection of Claim 3 be withdrawn.

Regarding the rejections of Claims 4, 5, 8, and 9 as unpatentable over Siska, it is noted that Claims 4, 5, 8, and 9 are dependent on Claim 11, and are thus believed to be patentable for at least the reasons discussed above with respect to Claim 11. Furthermore, it is respectfully submitted that the Office Action does not demonstrate why one of ordinary skill in the art, at the time of applicant’s invention, would have developed a design choice comprising applicant’s chosen materials. The materials in claims 4, 5, 8, and 9 comprising the air-permeable porous material are not inherent in the back housing 18 of Siska because Siska does not “make clear that the missing descriptive matter is necessarily present in the

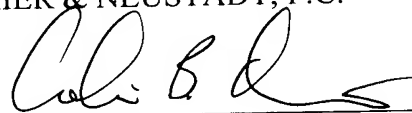
thing described in the reference, and that it would be so recognized by persons of ordinary skill.”² The Examiner has also not taken official notice that the choice of materials is well-known in the art. MPEP § 2144.03 states that “[o]fficial notice unsupported by documentary evidence should only be taken by the examiner where the facts asserted to be well-known, or to be common knowledge in the art are capable of instant and unquestionable demonstration as being well-known.” Accordingly, it is respectfully requested that the rejections of Claims 4, 5, 8, and 9 be withdrawn.

New dependent Claims 12-13 depend on new independent Claim 11. Thus, it is respectfully submitted that new Claims 12-13 patentably define over the cited reference for at least the reasons stated above with respect to Claims 1 and 11.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal allowance. A Notice of Allowance is earnestly solicited.

Respectfully submitted,

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² See MPEP § 2112, citing In re Robertson, 169 F.3d 743, 745 (Fed. Cir. 1999).

DESCRIPTION

HEADPHONE APPARATUS

TECHNICAL FIELD

The present invention relates to an improvement on a headphone apparatus, in which sound quality is improved, a feeling of pressure on an ear and a cooped-up feeling are alleviated, and a feeling of comfortableness is obtained when wearing the headphone apparatus.

BACKGROUND ART

A variety of headphone apparatuses of relatively high sound quality and of large size have been proposed; and typically, in order to generate an acoustic field space for naturally resonating in a back housing where a driver unit is housed, an headphone apparatus using a solid zelkova wood and the like are sold, however, the housing portion and ear pad portion thereof are large to cause an increase in weight.

FIG. 6 is a side sectional view showing a back housing portion used for a conventional headphone apparatus which is large and of high sound quality, shown in Patent Literature 1.

In FIG. 6, reference numeral 1 denotes an approximately circular or elliptical baffle board formed of material such as synthetic resin or wood through which no sound is transmitted.

A driver unit 5 is opposed to or fitted into a through-hole 4 made in the approximate center of this baffle board 1.

The driver unit 5 has a structure of an electrodynamic type in which a voice coil 5C fixed to a domed diaphragm 5A is driven between a magnet 5B and a concave yoke 5D, similarly to a typical loudspeaker.

A plurality of air ventilation holes 6A, 6B, ... are made with the through-hole 4 made in the center of the baffle board 1; and a highly air-permeable ventilation member 9 made of sponge, unwoven fabric or the like is attached to each of the through-holes 6A and 6B.

A domed back housing 2 covers the back surface of the baffle board 1 and is integrated with the baffle board 1 to form a housing 3 as a baffle portion.

A ventilation hole 7 is made in the back surface (top) of the housing 2, and a ventilation member 9 is attached similarly to the ventilation holes 6 in the baffle board 1 to enhance the baffle effectiveness. Nonferrous metal, synthetic resin, solid zelkova that is a wooden material as described above or the like is selected for the back housing 2, and an acoustic field space is made large to improve sound quality.

On the front surface of the baffle board 1 is provided an ear pad 8 in which an approximately ring-shaped cushion member made of sponge or the like is surrounded by an outer skin 10 made of synthetic resin, leather, cloth, or the like.

[Patent Literature 1] Published Utility Model Application

No. H5-36991 (FIG. 6)

DISCLOSURE OF THE INVENTION

In the headphone apparatus formed as described above, in order to secure the strength, in addition to the housing 3 a supporting member and the like which support a headband are formed of metal members and so the weight of the whole headphone apparatus becomes greater than is necessary.

When wearing such a large and heavy headphone apparatus on the head, there is a problem that heaviness and pressure are felt by the head and the ear, which intensifies a cooped-up feeling to cause an unpleasant wearing feeling.

Also, with a conventional structure, there is a problem that a typical cooped-up feeling of a headphone apparatus arises inevitably.

The present invention is made to eliminate the above problems and aims at obtaining a headphone apparatus in which an approximately cone-shaped air-permeable baffle portion having the baffle effectiveness is provided between a driver unit and an ear pad so as to remove a cooped-up feeling and to reduce resonance sharpness with obtaining light weight.

A second problem is dark noise originated from outside sound and the present invention is made to solve the problem and aims at obtaining a headphone apparatus in which a housing that houses a driver unit is formed of an air-permeable lightweight

member to prevent outside sound from being dark noise (not to be muffled).

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a side sectional view of a headphone unit used for a headphone apparatus of the present invention;

FIGS. 2A and 2B are front and side views of a headphone apparatus of the present invention;

FIGS. 3A and 3B are a perspective view of a baffle portion and a side sectional view of a back housing, used for a headphone apparatus of the present invention;

FIGS. 4A to 4C are enlarged views of a cross section of material, for explaining a porous material used for a baffle portion and a back housing in a headphone apparatus of the present invention;

FIG. 5 is a perspective view showing another structure of a headphone apparatus of the present invention; and

FIG. 6 is a side sectional view of a headphone unit used for a conventional headphone apparatus.

BEST MODE OF CARRYING OUT THE INVENTION

Hereinafter, an embodiment of the present invention will be described in detail with reference to FIGS. 1 to 4. FIG. 1 is a side sectional view of a housing portion which has a driver unit according to the present invention; FIGS. 2A and 2B are external views of a headphone apparatus according to the present

invention; FIGS. 3A and 3B are a perspective view of a baffle portion and a side sectional view of a back housing, used for the present invention; and FIGS. 4A to 4C are cross-sectional views of a part A in FIG. 3A, for explaining a method of processing an air-permeable member.

Regarding FIGS. 1 to 4, prior to explaining FIG. 1, the whole structure of a headphone apparatus of the present invention is explained referring to FIGS. 2A and 2B.

FIGS. 2A and 2B show a front view and a right side view of a headphone apparatus, respectively. In FIGS. 2A and 2B, a headphone apparatus 11 includes a flexible lightweight headphone band 12 made of a metal such as duralumin or magnesium alloy, or made of a carbon composite material or the like, and left and right headphone units 13L and 13R each including a driver unit.

In the left and right headphone units 13L and 13R is included a driver unit, and the driver units are held in left and right frames 14L and 14R, each of which includes a bridge portion 14B made of a lightweight metal member such as titanium alloy or magnesium alloy formed like a bridge in a rim 14A; and the headphone band 12 includes approximately U-shaped left and right band adjustment portions 16L and 16R fixed to approximately semicircular left and right pendent frames 15L and 15R pivotably attached to the left and right frames 14L and 14R. Inside the left and right frames 14L and 14R are provided ear

pads 27.

In FIG. 2A, reference numerals 17L and 17R denote cone-shaped left and right baffle portions described later on; in FIGS. 2A and 2B, reference numerals 19L and 19R denote left and right back housings similarly described later on.

Hereinafter, the left and right headphone units 13L and 13R of the present invention will be explained using FIGS. 1, 3 and 4.

In FIG. 1, in the left and right headphone units 13L and 13R (hereinafter called headphone units 13), a driver unit 20 constituting a loudspeaker is fitted into a through-hole 22 that is made in the center of a disk-like baffle board 21. The loudspeaker in the driver unit 20 has a structure of a typical dynamic type. In this driver unit 20, a reference numeral 23 denotes a yoke, 24 denotes a voice coil, 25 denotes a domed diaphragm and 26 denotes a disk-like magnet.

In frames 14 (14L and 14R), an arched bridge 14B is formed like a bridge to an annular-shaped rim 14A as shown in FIG. 1 and FIGS. 2A and 2B, using a lightweight alloy such as titanium alloy or magnesium alloy, and the baffle board 21 is fixed into a through-hole 14C made in the bridge 14B. In addition, a symbol 20A denotes a protector.

Behind the driver unit 20 is formed an approximately cap-like back housing 19 for maintaining a predetermined space

between the driver unit and the baffle board 21. The back housing 19 is locked by a through-hole 14D made in the bridge 14B of the frame 14.

Between the bridge 14B of the frame 14 and the rim 14A of the frame 14 is provided a baffle portion 17 which is cone-shaped similarly to a diaphragm of a loudspeaker.

An ear pad 27 in which a cushion material 28 made of expandable synthetic resin, sponge or the like and covered with an outer skin 29 made of soft cloth, leather or the like has been formed into a ring shape and in a front-rear asymmetrical manner (in a horizontally asymmetrical manner in FIG. 1) is attached to the rim 14A of the frame 14 through an attachment frame 31 integrally formed with the rim 14A of the frame 14.

FIGS. 3A and 3B show a perspective view and a side sectional view of the baffle portion 17 and the back housing 19 in the above-described headphone unit 13.

The baffle portion 17 provided between the bridge 14B and the rim 14A of the frame 14 as shown in FIG. 1 is approximately formed into the shape of a cone with an air-permeable porous material 32 having a porous structure, as shown in FIG. 3A. Pulp, unwoven fabric of chemical fiber (Eltas Smash® produced by ASAHI KASEI FIBERS CORPORATION), cellulose based material or the like can be used as the porous material, for example.

FIGS. 4A to 4C show enlarged cross-sectional views of the

part A in FIG. 3A in the thickness direction; and as shown in FIG. 4C, a kind of porous material 32 is selected from the above-described materials to be heated and pressed in a mold similar to the shape of FIG. 3A, and so the baffle portion 17 shown in FIG. 3A is molded.

An upper opening portion 17A of the cone-shaped baffle portion 17 shown in FIG. 3A is inserted and fixed in a groove portion in the bridge 14B of the frame 14 as shown in FIG. 1, and a lower opening portion 17B is inserted and fixed in a groove portion in the rim 14A of the frame 14.

FIG. 3B shows a modified example of the back housing 19 shown in FIG. 1, in which a through-hole 33 is made at the top of the back surface where the driver unit 20 in FIG. 1 is housed or a cap 35 provided with a large number of through-holes 34 is inserted and fixed in the through-hole 33. The back housing 19 is made of a porous material to be press-molded similarly to FIG. 1. A plurality of through-holes are provided as the through-holes 34 in the cap 35 to obtain a greater amount of airflow than that of the porous material. Further, other materials than a porous material, such as a predetermined air-impermeable synthetic resin or metal may also be selected for the cap 35.

Other methods of forming the above-described baffle portion 17 and back housing 19 are explained referring to FIGS. 4A and 4B.

FIGS. 4A and 4B are cases in which a plurality of porous materials are combined to form; in FIG. 4A, a composite sheet, in which on an air-permeable pulp 32A as a first layer of a porous material is bonded a nylon cloth 32C of a second porous material through an adhesive sheet 32B of an unwoven cloth provided with predetermined holes, is used to obtain the baffle portion 17 and the back housing 19 press-molded into predetermined shapes shown in FIGS. 3A and 3B.

The structure shown in FIG. 4B is a sheet in which on an air-permeable chemical fiber unwoven fabric 32D as a first layer is laminated an air-permeable cellulose or chemical fiber based unwoven fabric 32F as a second layer through an air-permeable double-faced adhesive sheet 32E, and the baffle portion 17 and the back housing portion 19 are formed by molding the sheet into a predetermined shape.

In the above described composite sheets, cloth-cloth and pulp-cloth are used as combinations between first and second layers, however, pulp-pulp, cloth-pulp combinations and the like can be used as the first and second layers to stabilize the shapes of the baffle portion 17 and the back housing 19.

According to the above-described structures of the back housing 19 and the baffle portion 17, since sound entered from the outside permeates into a space between the baffle board 21 and the back housing 19 where the driver unit 20 is housed

without being shut out, sound from the outside can be prevented from being ~~dark noise and~~ trapped inside the housing, such that clear sound which is not muffled can be emitted.

Further, the baffle portion 17 is made into a predetermined cone shape so that low sound is concentrated in the earhole, and characteristics in the low range can be set as desired by allowing air in the space surrounded by the baffle portion 17 to permeate from the outside to inside and from the inside to outside, which greatly improves low-range frequency characteristics together with the bass lens effectiveness to thereby obtain a headphone apparatus in which weight is reduced not to cause a feeling of heaviness and a feeling of pressure due to lateral pressure on the ear, when being worn on the ear.

The present invention can be applied to a headset in which a microphone 40 is added to the above-described headphone apparatus, as shown in FIG. 5.

INDUSTRIAL APPLICABILITY

According to the present invention, a headphone apparatus and a microphone-attached headphone apparatus in which the baffle effectiveness can further be enhanced by means of the bass lens effectiveness are obtained by providing driver units at positions away from the positions of both ears.

ABSTRACT

A headphone unit including a back housing provided at the rear of a driver unit and a baffle portion provided at the front thereof. In the headphone apparatus, the baffle portion, which is formed to surround a space except a front opening portion of a driver unit, and/or the back housing portion, which is formed to cover the back surface of the driver unit, are formed using the air-permeable porous material.